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⑤ Boeing Co., Seattle, Wash.

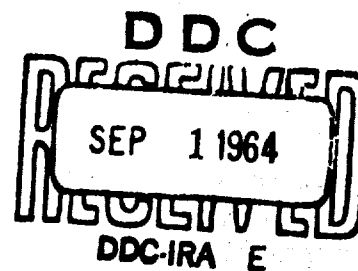
THE BOEING COMPANY
AERO-SPACE DIVISION

⑥ ROCKET PLUME RADIATION AND SUPPRESSION

⑮ CONTRACT AFOL(695)/22

⑨ First Monthly Letter Report no. 1,
⑪ May 10, 1962

Prepared for
SPACE SYSTEMS DIVISION
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ROCKET PLUME RADIATION AND SUPPRESSION

Program Objectives

The objectives of this program are to conduct analytical and laboratory studies of rocket plume radiation and techniques for plume radiation suppression. Experiments are to be conducted at reduced pressures to determine the spectral and spatial distribution of the radiation from selected liquid and solid propellant combinations, and to investigate means of reducing the infrared and ultraviolet radiation of rocket plumes by introducing fuel additives to these propellant combinations.

Summary of Work Accomplished

Development of the test plan has been initiated. The proposed schedule is shown on the attached chart. The Boeing Jet Laboratory Group has prepared motor and facility design drawings in preparation for the initial experimental studies.

Infrared and optical instrumentation has been developed or improved as follows:

1. A Perkin-Elmer Model 98 monochromator has been modified for use through the ultraviolet, visible and near-infrared regions. It will scan from 0.2 to 1.2 microns in 0.2 to 0.5 seconds. Two photomultipliers, having S-1 and S-5 responses, are used with a beam splitter to allow operation over this spectral region. A three-inch diameter reflective collecting system has also been installed.

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2. An ultraviolet-visible radiometer has been constructed. It uses the same photomultipliers as the ultraviolet-visible monochromator (Item 1) and will likewise be sensitive between 0.2 and 1.2 microns. Field limiting apertures are used in this instrument rather than collecting optics.
3. The 35 mm pulse camera, used in earlier work, will not be modified.
4. The Perkin-Elmer Model 108 rapid scan monochromator was examined and found optically satisfactory. This instrument provides spectral coverage from 1.2 to 5.5 microns.
5. Narrow band filters at 2.7 and 4.3 microns are being ordered for installation in the Barnes R4F2 dual-channel radiometer, according to specifications supplied by the project officer.
6. The audio-modulation radiometer has been completed and tested with a laboratory burner. Its lead sulfide detector drives two data channels. A d.c. channel records the plume radiance, and a 2 to 5000 cps channel records the audio-modulation component. Three-inch Cassegrain collecting optics are used with the system.
7. The total radiometer will be the same as used in previous tests. It is a Barnes R-8B1 radiometer with 3-inch optics attached and is filtered for 1.2 to 5.5 micron spectral coverage.

Activities Planned for May 1962

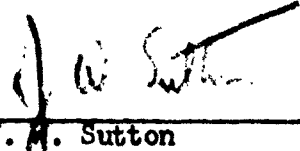
The infrared instrumentation will be completed.

1. The rapid scan monochromator rate will be reduced to 5 spectra per second. A chopped global source will be constructed for transmission measurements in the infrared.
2. The scanning radiometer will be modified to allow operation out to 4.3 microns. A new window and scanning mirror installation is required for this modification.

Preliminary calibrations will be performed on the instruments as necessary. In particular, the ultraviolet-visible monochromator will be calibrated in wavelength and absolute intensity and used to cross calibrate several tungsten lamps. These lamps will in turn be used to calibrate the ultraviolet-visible radiometer.

Test preparations will proceed at Boeing Jet Laboratory, with goal of initial experimental runs in early June. Analytical studies of the effects of additives on solid propellant and non-hydrocarbon liquid propellant systems will be commenced. The trade-off studies of the total effect of tri-component radiation suppression on system performance will be started.

Submitted by:


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Approved by:


E. L. Chupp
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PROPOSED PROGRAM SCHEDULE

Rocket Plume Radiation and Suppression

1962-1963

	A	M	J	J	A	S	O	N	D	J	F	M	A
Analytical studies													
Trade-off analysis of missile performance	<div style="text-align: center;"> </div>												
Theoretical rocket performance analysis	<div style="text-align: center;"> </div>												
Experimental program													
1. 1000 lb. RP-1, O ₂ motor	<div style="text-align: center;"> </div>												
2. Advanced liquid propellant motor	<div style="text-align: center;"> </div>												
3. Solid propellant motors	<div style="text-align: center;"> </div>												
Data reduction and analysis	<div style="text-align: center;"> </div>												
Technical reports	<div style="text-align: center;"> </div>												
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